Extraction and Spectrophotometric Determination of Cu (II) Metal ions using Hydrazinecarboxymide2-[(2-hydroxyphenyl) methylene (HC22HPM) as an Analytical Reagent

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Abstract: A spectrophotometric method has been developed for the determination of Cu (II) using Hydrazinecarboxymide2-[(2-hydroxyphenyl) methylene (HC22HPM)[1] as an extractive reagent .The reagent forms a colored complex which has been quantitatively extracted into n-butanol at pH 6.80. The method obeys Beer's law over a range of 1 to 10 ppm. The molar absorptivity is 0.33290 X 10^5 L $mol^{-1}cm^{-1}$ and Sandell's sensitivity is 0.01220 µg cm^{-2} respectively. The propose method is very sensitive and selective. This method has been successfully applied to synthetic and commercial samples.

Keywords: Copper, Spectrophotometric determination, n-butanol, Hydrazinecarboxymide2-[(2-hydroxyphenyl) methylene (HC22HPM).

INTRODUCTION

The cursory look at the literature survey revels the fact that Copper reacts with many organic reagents. It also indicates that some of the reagents recommended suffering through limitations such as interference of Ni(II)[2], W(VI)[3], etc. complex formation takes place after several minutes[4,5] some of the regents are not selective[6,7] and sensitive also some are less stable[8] In this paper a new method has been developed using Hydrazinecarboxymide2-[(2-hydroxyphenyl) methylene (HC22HPM) for extraction and Spectrophotometric determination of copper Cu (II), which is simple, selective and sensitive.

EXPERIMENTAL

The reagent Hydrazinecarboxymide2-[(2-hydroxyphenyl) methylene (HC22HPM) was synthesized by the given procedure[1]. The stock solution of Cu (II) was prepared by dissolving a weighed amount of copper sulphate pentahydrate in double distilled water and then diluted to the desired volume with double distilled water and standardized with EDTA[1]. The absorbance and pH measurements were carried out on a Shimadzu UV-Visible 2100 spectrophotometer with 1 cm quartz cells and digital pH meter with combined glass electrode respectively.

PROCEDURE FOR THE EXTRACTION:

0.1 ml of aqueous solution containing 1µg of copper metal and 2 ml of reagent was mixed in a 50 ml beaker. The pH of the solution adjusted to 6.8, it must be noted that the total volume should not exceed 10 ml. The solution was transferred to 100 ml separatory funnel. The beaker was washed twice with n-butanol and transferred to the same funnel. The two phases were shaken for two minutes and allowed to separate. The organic phase was passed through anhydrous sodium sulphate in order to absorb trace amount of water from

organic phase and then collected in 10 ml measuring flask and made up to the mark with organic solvent if required. The amount of copper present in the organic phase determined quantitatively by spectrophotometric method by taking absorbance at 359 nm and that in the aqueous phase was determined by EDTA method.

RESULTS AND DISCUSSION:

The results of various studies are discussed below.

Extraction as a function of pH:

The extraction of copper with Hydrazinecarboxymide2-[(2-hydroxyphenyl) methylene (HC22HPM) has been studied over the pH range 1-10 and was observed that percentage extraction of Cu (II) is maximum at pH 6.8.

Absorption spectrum:

The absorption spectrum of Cu (II): Hydrazinecarboxymide2-[(2-hydroxyphenyl) methylene (HC22HPM) in n-butanol shows the maximum absorption at 359 nm. The absorption due to reagent at this wavelength is nearly negligible. Hence the absorption measurements were carried out at 359nm.

Influence of diluents:

The suitability of solvent was investigated using various organic solvents and the extraction of Cu (II):HC22HPM was quantitative in n-butanol. Hence, n-butanol was used for further extraction studies as it gave better and quicker phase separation.

Effect of reagent concentration:

It was found that 2 ml of 0.1% reagent is sufficient for the colour development of the metal
Cu (II) in 10 ml of aqueous solution at pH 6.8.

Effect of equilibration time and stability of the complex:

The equilibration time of 1-2 minute is sufficient for the quantitative extraction of Copper. The stability of colour of the Cu (II):HC22HPM complex with respect to time shows that the absorbance due to extracted species is stable up to 24-30 hours, after which slight decrease in absorbance is observed.

Calibration plot:

The Beer's law is obeyed from 1 to 10 ppm. The molar absorptivity and sandell's sensitivity were calculated to be is 0.33290 X 10^5 L $mol^{-1}cm^{-1}$ and 0.01220 µg cm^{-2} respectively. (Fig 1).

Effect of divalent ions and foreign ions:

The effect of other ions present in various amount indicated no interference in the spectrophotometric determination of 10 ppm of Copper. The ions which show interference in the spectrophotometric determination of Copper were overcome by using appropriate masking agents.(Table no 1)

Precision and accuracy:

The precision and accuracy of the developed spectrophotometric method have been studied by analyzing ten solutions each containing 5 µg of Copper in the aqueous phase. The average of ten determinations was 5.023 and variation from mean at 95% confidence limit was ± 0.0449.

Nature of extracted species:

The composition of extracted Cu (II) : HC22HPM complex has been determined by Job's continuous variation method, Slope ratio method and Mole ratio method. It shows that the composition of Cu (II): HC22HPM complex is 1:2 (Fig 2).

Applications:

The proposed method was successfully applied for the determination of Copper from various alloys, ores and pharmaceutical samples. The results found to be in good agreement with those obtained by the standard known method. (Table 2).

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Table No 1

Effect of divalent ions and foreign ions:

Sr. No.	Interfering ions	Masking agents added
1	pb(II),	Sodium thiosulfate
2	Th(IV)	Sodium fluoride
3	Citrate, Tartarate,	Sodium molybdate
4	Ni(II)	Sodium cynide
5	Zr(IV)	Sodium fluoride
6	Be(II)	Sodium fluoride
7	Se(IV)	Oxidation with KMnO4
8	CN-	Boiling with Conc. HNO3 and Formaldehyde
9	Cr(II)	Ammonium acetate
10	Cd(II)	Potassium iodide
11	Ag (I)	Potassium iodide

Table No 2

Application in different samples

Synthetic mixtures

Synthetic mixture	Cu(II) standard ppm	Cu(II) present ppm
Cu(II) + Cd(II) + Zr(IV) (10 + 10 + 10)	10	9.82
Cu(II) + Pt(IV) + Mn(II) (10 + 10 + 10)	10	9.75
Cu(II) + Mg(II) + Ni(II) (10 + 10 + 10)	10	9.90

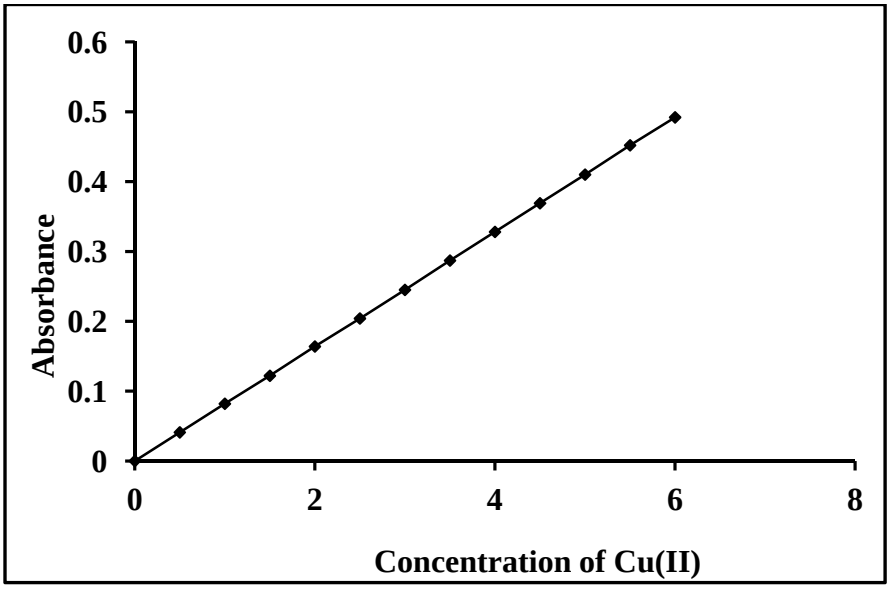
Alloy Samples

Sample	% Cu(II) Standard method	% Cu(II) present method
Brass	80	79.32
Monel	90	90.09
Devarda's	48	47.6
Cupra nickel	35	34.78
German silver	50	49.8

Pharmaceutical samples

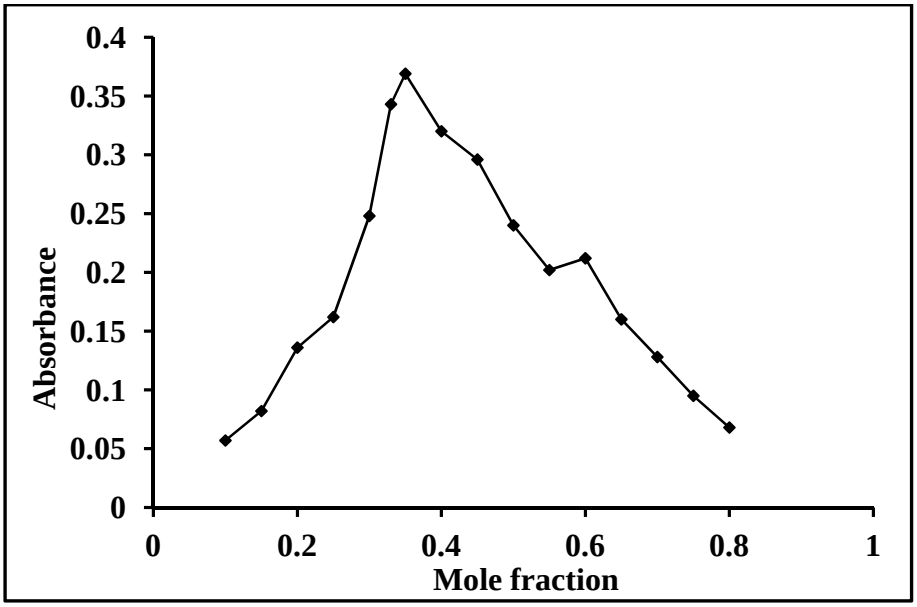
Pharmaceutical samples	Cu(II) standard ppm	Cu(II) present ppm
Multivitamin tablet	5	4.75
Coversyl tablet	4	3.80
Light honey	0.290	0.278
Dark honey	0.560	0.545

Fig 1



CALIBRATION CURVE FOR Cu(II) : HC22HPM

Fig 2



JOB'S CONTINUOUS VARIATION METHOD